

IN THE SPECIFICATION

Please replace the entire paragraph beginning on page 12, line 8 with the following:

An exemplary one-way conventional satellite broadcast system 100 is depicted in FIG. 1. The present invention is designed to control the burst timing of a group of return channels that share the same frame timing, as previously mentioned. For simplicity, this system is characterized in FIG. 2 as including one or more Network Operations Center (NOC) 210 (also commonly known as a “hub”, “outroute”, “control node”, “control station”, or “earth station”, etc.), at least one satellite 130 having uplink and downlink transponders, system time reference 240 which provides common symbol timing to each NOC 210 in the system, one or more (i.e., 1 to n) remote users 150 at a user node, each having a satellite receive and transmit capability provided by an associated transceiver 230. NOC 210 preferably provides access to the internet or an intranet through gateway 160. NOC inroute receiver ~~260~~ 620 (shown on Figure 6) may be collocated with NOC 210, or may be separate from NOC 210.

Please replace the entire paragraph beginning on page 14, line 8 with the following:

Turning to FIG. 4, transceiver 230 preferably supports TCP/IP applications, e.g. web browsing, electronic mail and FTP, and also multimedia broadcast and multicast applications using IP Multicast, e.g. MPEG-1 and MPEG-2 digital video, digital audio and file broadcast. Transceiver 230 provides a high-speed, over-the-air return channel as an alternative to a low-speed terrestrial link. Transceiver 230 contains receiver (RCVR 140), processor 420, RF transmitter (RF XMTR) 430, timing recovery section 440, and Transmit Unit (TU) 450. RF XMTR 430 modulates and transmits, in burst mode, the in-bound carrier to satellite 130 and NOC 210 (shown on Figure 2). RF XMTR 430 may operate with, and be controlled by RCVR 140 via processor 420, which also could master RCVR 140 by use, for example, of a Universal Serial Bus (USB) adapter (not shown). Configuration parameters and inbound data from processor 420 may be input to RF XMTR 430 through a serial port (not shown), and transmitter status information from RF XMTR 430 may also be provided through the serial port

to processor 420. TU 450 conditions the outgoing data signal by incorporating the appropriate signal protocols and modulation scheme, e.g. a IP/DVB protocol and TDMA using QPSK techniques.

Please replace the entire paragraph beginning on page 15, line 8 with the following:

A discussion of the nature and approach of the synchronized timing system and method of the present invention follows. FIG. 5 shows return channel equipment (RCE) 510 at NOC 210 (shown on Figure 2) and its interface with NOC timing section 550. RCE 510 reassembles packets received from remote users 150 (shown on Figures 2 and 4) over the return channels into IP packets for further processing. Frame timing transmitted in the broadcast stream to remote users 150 (shown on Figures 2 and 4) and ultimately used for uplink timing in the return channels is derived from a pulse from NOC frame pulse generator (NOC FPG) 520 in RCE 510. NOC FPG 520 allocates bandwidth, coordinates the aperture configuration, and sends framing pulses to burst channel demodulator (BCD) 530. The number of BCDs 530 supported by RCE 510 is preferably at least 32, to allow redundant equipment support for at least 28 return channels. Multiple sets of return channel equipment 510 may be provided in a networked cluster arrangement (not shown) within each NOC 210 to allow for processing of a large number of return channels, preferably up to 100,000 or more, for example. Return channel traffic from the remote users provided from the NOC RF section 610 (see FIG. 6) and routed through system signal distribution section 540 is applied to BCD 530 to demodulate return channel data received from the remote users.

Please replace the entire paragraph beginning on page 16, line 28 with the following:

NOC FPG 520 periodically causes RCE 510 to send a superframe marker pulse to NOC delay receiver 551 and echo timing receiver 552 through NOC timing section 550 once every integral number of TDMA frames, e.g. 8 frames or 360 milliseconds (ms). At the same time, it sends a superframe header which is included in the broadcast stream transmitted from NOC 210

(shown on Figure 2) for reception by a RCVR 140 (shown on Figure 4) located at one or more remote users 150 (shown on Figures 2 and 4), and which is also received in the broadcast by NOC echo timing receiver 552 from satellite 130 (shown on Figures 2 and 4).

Please replace the entire paragraph beginning on page 17, line 5 with the following:

The equipment, signals, and subsystems of each of NOC 210 (shown on Figure 2) and transceiver 230 (shown on Figure 2) are preferably interconnected via one or more local area networks (LAN) (not shown) and, even more preferably, are interconnected in accordance with a so-called open system architecture which allows modifications and upgrades to be more easily accomplished as improvements in software and hardware become available.

Please replace the entire paragraph beginning on page 17, line 11 with the following:

The concept in the timing approach of the present invention is to provide information to RCVR 140 (shown on Figure 4) so that transceiver 230 (shown on Figure 2) may precisely time its burst transmission time as an offset of the received superframe header. The superframe header received in a superframe numbering packet (SFNP) transmitted in the broadcast is used by every remote user 150 (shown on Figures 2 and 4) to synchronize their transmit start of frame marker to the superframe marker pulse generated by NOC FPG 520. This packet is used to lock network timing for the return channels, and as a beacon to identify which satellite network is being connected to. Remote user 150 (shown on Figures 2 and 4) may also be configured to receive several PID addresses, including the one to be used with its associated NOC FPG 520. Further, each NOC FPG 520 may be allocated its own private PID to ensure that remote users 150 (shown on Figures 2 and 4) receive traffic only from their assigned NOC FPG 520.

Please replace the entire paragraph beginning on page 18, line 5 with the following:

To be able to adjust for satellite drift, a known process called “echo timing” is implemented at NOC 210 to measure changes in position of satellite 130. This measures the transmission time from NOC 210 to satellite 130 and, from this measurement, determines the satellite drift relative to NOC 210 which is used to approximate the drift of satellite 130 from the position of remote user 150. These values are used to correct the ranging values determined during initialization. The NOC-to-satellite portion of the satellite delay is sent in the SFNP message and is determined as the difference between timing signals from NOC delay receiver 551 (shown on Figure 5) and echo timing receiver 552 (shown on Figure 5). Each remote user 150 preferably has a preconfigured value for the satellite-to-remote user delay that is determined during system installation. The NOC delay at ranging is stored, and the change in NOC delay is applied to the receiver-satellite delay to approximate the time delay associated with satellite drift. The NOC-satellite drift timing is preferably provided in a subsequent SFNP message to remote users 150 so that current drift timing, relative to the initial ranging NOC-satellite echo delay, can be determined for an upcoming transmit frame.

Please replace the entire paragraph beginning on page 18, line 23 with the following:

In addition to not knowing the satellite drift, remote user 150 does not know the delay within NOC 210, i.e. NOC outroute delay, which can vary in real-time. The internal NOC delay measures the delay from the time the superframe marker pulse is provided by NOC FPG 520 (shown on Figure 5), until the time the frame pulse is actually transmitted in a message on the broadcast from NOC 210.

Please replace the entire paragraph beginning on page 19, line 10 with the following:

NOC FPG 520 (shown on Figure 5) pulses NOC delay receiver 551 (shown on Figure 5) and echo timing receiver 552 (shown on Figure 5). After a time interval approximately equal to the STO elapses, NOC FPG 520 (shown on Figure 5) provides a frame pulse to BCD 530 (shown on Figure 5). This frame pulse could be provided, for example, once every 45 ms, the preferred frame duration. The STO represents a calculation of the maximum round-trip time from the farthest remote user 150, plus two frame times. A two frame delay is provided as a buffer to ensure that transceiver 230 at remote user 150 has sufficient time to process return channel frame format data, and to provide return channel data for transmission at least one-half frame time ahead of the actual frame transmit time.

Please replace the entire paragraph beginning on page 19, line 20 with the following:

The operation of the communication timing system of the present invention will now be described. NOC outroute 600 takes formatted data packets and transmits them on the DVB transport stream 220 (shown on Figure 2) to satellite 130 for further retransmission to remote users 150. The data stream or “payload” information is transmitted following an appropriately formatted MPE header and initialization vector, if the packets are encrypted.

Please replace the entire paragraph beginning on page 19, line 26 with the following:

Included in the DVB transport stream 220 (shown on Figure 2) is a SFNP which provides a superframe marker, as well as the internal NOC delay and satellite drift correction for a previous superframe marker transmitted in a prior SFNP.

Please replace the entire paragraph beginning on page 20, line 1 with the following:

When remote user 150 receives a SFNP at their respective RCVR 140 (shown on Figure 4), the received superframe packet is tagged with a local time-stamp. This local time-stamp may be created using an internal counter (not shown), which preferably is a 32-bit counter free-running at 32 MHz, for example. Each of the remote sites must determine when the most recently received superframe marker actually occurred at the NOC outroute 600. To do so, each remote user 150 subtracts its known satellite delay, corrected for drift, and the internal NOC delay provided in a subsequently received SFNP Message from the local time of receipt of the previously received superframe packet.

Please replace the entire paragraph beginning on page 20, line 25 with the following:

Knowing when the superframe marker should occur allows the remote user 150 to align the start of a transmit (Tx) frame marker in TU 450 (shown on Figure 4) with the NOC superframe marker pulse. TU 450 (shown on Figure 4) preferably has a free-running counter (not shown) that runs synchronously with an internal counter (also not shown) in its associated RCVR 140 (shown on Figure 4). After a period of time equal to the duration of a return channel frame, e.g. 45 ms, this TU counter value is latched, and an interrupt to its RCVR 140 (shown on Figure 4) is generated to read the value of the counter in RCVR 140 (shown on Figure 4). The local time at which this interrupt occurs is compared to when the interrupt should have occurred. This time difference is stored in TU 450 (shown on Figure 4) to correct for the proper transmit time start. RCVR 140 (shown on Figure 4) also provides a nominal frame length counter to TU 450 (shown on Figure 4) to adjust its frame timing. Once the frame timing is adjusted, a nominal value, e.g. close to 45ms, will preferably be used on a continuing basis with minor adjustments to account for drifts between the counter and the timing pulse. Once TU 450 (shown on Figure 4) is aligned, there are only small corrections necessary to keep TU 450 (shown on Figure 4) synchronized to NOC 210. Transceiver 230 (shown on Figures 2 and 4)

then uplinks a message at the appropriate time which is received by NOC RF section 610 and processed in NOC inroute receiver 620

Please replace the entire paragraph beginning on page 21, line 14 with the following:

The following describes some of the calculations that are performed in both NOC 210 and RCVR 140 (shown on Figure 4) to regenerate the proper frame timing. The timing variable "OFFSET" represents the aforementioned local offset time. For these calculations, Table 1 provides a listing and description of timing equation variables.